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SECURITY INFORMATION

PROVISIONAL INTELLIGENCE REPORT

CONSUMPTION OF PETROLEUM PRODUCTS BY SOVIET AGRICULTURE

CIA/RR PR-34

17 July 1953

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Chart

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CONSUMPTION OF PETROLEUM PRODUCTS BY SOVIET AGRICULTURE*

Summary

The importance of agricultural tractors, combines, and stationary motors as consumers of petroleum products is illustrated by the fact that these units consumed over 30 percent of the distillate petroleum products -- gasoline, ligroine, kerosene, and diesel fuel -- manufactured in the USSR in 1951. Consumption of petroleum products by these units increased from 5.5 million to 7.6 million metric tons per year between 1940 and 1951. Based on the Fifth Five Year Plan (1951-55), agricultural consumption** should increase to 13.5 million metric tons by 1955.

Tractors account for a very large part of the consumption of petroleum products by Soviet agriculture. As a result, tractor kerosene is the most important Soviet agricultural fuel. Kerosene represented 58 percent of all agricultural consumption in 1951. Diesel fuel, however, is becoming increasingly important as a tractor fuel. Diesel fuel accounted for only 3 percent of the total fuel consumption by agriculture in 1940, whereas it will account for almost 29 percent of the total in 1955. Ligroine, important before the war as a tractor fuel, has become less significant in the postwar period. Consumption of lubricants by agriculture is on the increase, partly because of the heavier requirements of diesel tractors for lubricants.

It is believed that a considerable degree of confidence may be placed in these estimates, since it has been possible to derive data from Soviet sources for 1940, 1947, and 1951. Forecasts included in this report are based on an acceptance of the data in the Fifth Five Year Plan.

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1. Introduction.

The significance of agriculture as a consumer of petroleum products in the USSR is indicated by the fact that agricultural tractors, combines,

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* This report contains information as of 31 December 1952.

** The consumption of petroleum products by motor transport in agriculture is not reported in the body of the text, but a preliminary estimate is given in Appendix A, Section 4.

and stationary motors are estimated to have consumed more than 18 percent of all the petroleum products produced in the USSR in 1951. More important, these units consumed over 30 percent of all the distillate petroleum products (gasoline, ligroine, kerosene, and diesel) produced in the USSR in the same year. These are the petroleum products which have particular strategic importance, since they include the principal military fuels.

2. Breakdown of Consumption.

a. By Type of Agricultural Machine.

The estimated consumption of petroleum products by agriculture in the USSR during 1940-55 is summarized in Table 1* and on the accompanying chart.** These estimates include the petroleum products consumed by tractors, combines, and stationary motors in agriculture and the petroleum products consumed by tractors in the timber industry.

The amounts of petroleum products used for the generation of electric power in agricultural installations in the USSR are not included in these estimates. The petroleum products consumed by motor transport in Soviet agriculture are also excluded from the present estimates, since it is more convenient, when dealing with the consumption of petroleum products in the USSR, to treat all motor transport as a unit. It is, however, recognized that there is occasional need for estimates of the consumption of petroleum products by motor transport in Soviet agriculture, and preliminary order-of-magnitude estimates for this item are presented in Appendix A, Section 4.

From the data presented in Table 1 and the accompanying chart, it may be noted that consumption of petroleum products by the agricultural machines indicated is estimated to have increased from a total of 5.5 million metric tons in 1940 to approximately 7.6 million metric tons in 1951, an increase of about 38 percent. Projected consumption in 1955, based on data from the Fifth Five Year Plan (1951-55), reaches a level of almost 13.5 million metric tons. This level would represent an increase of 145 percent over the prewar level and of about 105 percent over the 1950 level.

Considerable confidence may be placed in the estimates of past and present consumption of petroleum products by agricultural tractors, as presented in Table 1. This is especially true for the estimates for 1940, 1947, and 1951, where the range of error should not exceed plus or minus 5 percent, since these estimates are based on Soviet figures concerning consumption of petroleum products (see Appendix A). In the case of estimates

* Table 1 follows on p. 3.

** The chart, Estimated Consumption of Petroleum Products by Agriculture in the USSR, 1940, 1947-55, follows p. 4.

Table 1

Estimated Consumption a/* of Petroleum Products by Agriculture in the USSR b/ by Types of Machines 1940, 1947, and 1950-55

Million Metric Tons

	1940	1947	1950	1951	1952	1953	1954	1955
Agricultural Tractors								
Gasoline	0.06	0.07	0.13	0.14	0.18	0.21	0.24	0.27
Ligroine	0.88	0.53	0.38	0.39	0.44	0.47	0.52	0.56
Kerosene	3.51	3.32	4.01	4.40	4.84	5.43	6.02	6.65
Diesel	0.17	0.05	1.00	1.40	1.98	2.52	3.13	3.81
Lubricants	0.47	0.41	0.64	0.74	0.90	1.06	1.23	1.41
Subtotal	5.09	4.38	6.16	7.07	8.34	9.69	11.14	12.71
Combines								
Gasoline	0.35	0.26	0.30	0.41	0.51	0.57	0.62	0.66
Lubricants	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Subtotal	0.36	0.27	0.31	0.42	0.52	0.58	0.63	0.67
Stationary Motors and the Timber Industry								
Gasoline	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Diesel	N.A.	N.A.	0.05	0.05	0.05	0.05	0.05	0.05
Subtotal	0.05	0.05	0.10	0.10	0.10	0.10	0.10	0.10

* Footnotes to Table 1 follow on p. 4.

Table 1

Estimated Consumption a/ of Petroleum Products
by Agriculture in the USSR b/ by Types of Machines
1940, 1947, and 1950-55
(Continued)

Million Metric Tons

	1940	1947	1950	1951	1952	1953	1954	1955
Total								
Gasoline	0.46	0.38	0.48	0.60	0.74	0.83	0.91	0.98
Ligroine	0.88	0.53	0.38	0.39	0.44	0.47	0.52	0.56
Kerosene	3.51	3.32	4.01	4.40	4.84	5.43	6.02	6.65
Diesel	0.17	0.05	1.05	1.45	2.03	2.57	3.18	3.86
Lubricants	0.48	0.42	0.65	0.75	0.91	1.07	1.24	1.43
Total All Products	5.50	4.70	6.57	7.59	8.96	10.37	11.87	13.48

a. Based on consumption of petroleum products during operation. Does not include fuels, lubricants, and solvents used for maintenance and overhaul of machines, nor does it include petroleum products used by motor transport in agriculture.
b. See Appendix A for the derivation of these figures.

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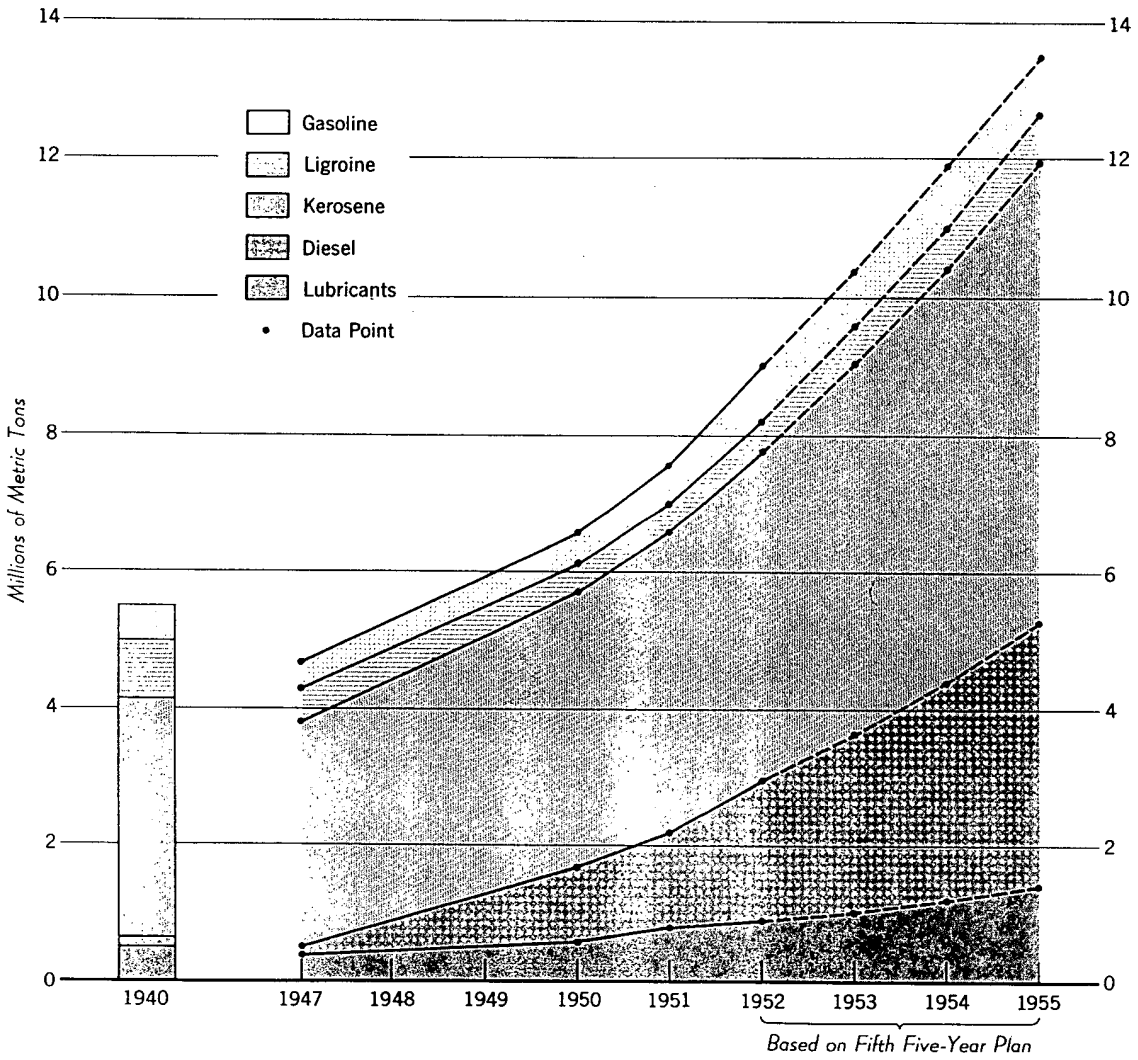
ESTIMATED CONSUMPTION OF PETROLEUM PRODUCTS BY AGRICULTURE IN THE USSR 1940, 1947-55*



*Excludes consumption of Motor Transport in Agriculture

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concerning present and past consumption by combines, the range of error should not exceed plus or minus 10 percent. Care should be exercised in using the estimates covering stationary motors and tractors in the timber industry. It seems probable, however, that the over-all estimates of consumption by agriculture should not be in error by more than plus or minus 10 percent for past and present periods. Since estimates for the period 1952-55 are based largely on Fifth Five Year Plan data, it is not possible to estimate the degree of error which may be present.

The accompanying chart presents graphically the total consumption of petroleum products by the agricultural machines shown in Table 1. From the chart it may be noted that the consumption of all types of petroleum products by these agricultural machines decreased between 1940 and 1947. This decrease was largely a result of the depletion of the Soviet tractor park during World War II. Since 1947, consumption of all types of petroleum products has been increasing annually, although the rates of growth in the demand for various products have differed. Between 1950 and 1955 the upward trend in the consumption of almost all petroleum products is expected to continue.

b. By Petroleum Product.

As will be seen from the chart, kerosene was the principal agricultural fuel in the prewar period and is expected to continue to be the most important fuel, quantitatively. The relative importance of kerosene, however, is expected to decline. In 1940, kerosene accounted for 63 percent of all petroleum products consumed by agriculture. By 1951 this percentage had fallen to about 58 percent, and by 1955 it is expected to decline to just under 50 percent.

Diesel fuel, on the other hand, has become more important as an agricultural fuel in the postwar period because the proportion of the tractor park which is diesel-powered has been steadily increasing. In 1940, diesel fuel accounted for only 3 percent of all petroleum products consumed by agriculture, by 1951 it accounted for 19 percent, and by 1955 it is expected to account for almost 29 percent.

The demand for both fuels increases absolutely during the periods considered, but the demand for kerosene is expected to increase by only 89 percent between 1940 and 1955, whereas the demand for diesel fuel in agriculture is expected to increase by almost 2,200 percent during the same period. This increase reflects the increasing number of diesel tractors used in agriculture.

Ligroine is becoming progressively less important as an agricultural fuel. In 1940, ligroine accounted for about 16 percent of the total

agricultural requirements. By 1951, ligroine accounted for only 5 percent of the total agricultural consumption. The decreased importance of ligroine tractors accounts for this decreased consumption.

The consumption of gasoline and lubricants accounts for the remainder of the consumption of petroleum products by agricultural tractors, combines, and stationary motors. Gasoline consumption, never quantitatively an important part of the total consumption of these units, nevertheless shows a significant increase between 1940 and 1955. This is a result of increased requirements for gasoline as a starter fuel for tractors consuming heavier petroleum products and of the increased consumption of gasoline by combines. The consumption of lubricants also shows a significant increase, particularly because diesel tractors, which account for an increasingly large part of the tractor park, consume a higher percentage of lubricants in relation to basic fuels.

c. By Economic Region.*

Table 2** presents a breakdown of total consumption of fuel by agricultural tractors, combines, and stationary motors in the USSR by economic regions for 1940, 1950, and 1955. Because the breakdown was made on the basis of 1951 Plan data and is not considered to be accurate, only the total consumption of all petroleum products by these agricultural machines has been prorated to the various economic regions. These estimates must be regarded as having a range of possible error of plus or minus 10 percent for 1940 and a progressively larger range thereafter.

From this breakdown it may be noted that Ecomomic Regions III, IV, VI, and VII account for the greatest consumption of fuel by these agricultural machines. These four regions, taken together, account for over 61 percent of the total consumption of petroleum products by Soviet agriculture.

* The term region in this report refers to the economic regions defined and numbered on CIA Map 12408, 9-51, USSR: Economic Regions.
** Table 2 follows on p.7.

Table 2

Estimated Regional Consumption of Petroleum Products
by Agriculture in the USSR
1940, 1950, and 1955

Economic Region	Amount (Million Metric Tons) 1940	1950	1955	Percent of Total Consumption 1/*
Northwest (Ia)	0.03	0.04	0.08	0.6
Northern European USSR (Ib)	0.03	0.04	0.08	0.6
Baltic (IIa)	0.18	0.21	0.43	3.2
Belorussia (IIb)	0.08	0.09	0.19	1.4
Ukraine (III)	1.16	1.38	2.83	21.0
Lower Don-North Caucasus (IV)	0.61	0.74	1.51	11.2
Transcaucasus (V)	0.07	0.09	0.18	1.3
Volga (VI)	0.91	1.08	2.22	16.5
Central European USSR (VII)	0.69	0.83	1.70	12.6
Urals (VIII)	0.53	0.63	1.29	9.6
West Siberia (IX)	0.44	0.53	1.08	8.0
Kazakh SSR (Xa)	0.28	0.33	0.69	5.1
Central Asia (Xb)	0.27	0.32	0.66	4.9
East Siberia (XI)	0.16	0.19	0.39	2.9
Far East (XII)	0.06	0.07	0.15	1.1
Total	5.50	6.57	13.48	100.0

* Footnote references in arabic numerals are to sources listed in Appendix C.

APPENDIX A

METHODOLOGY

1. Agricultural Tractors.

a. 1940, 1947, and 1951.

Consumption of petroleum products by agricultural tractors is calculated by multiplying the average consumption of petroleum products per hectare* of tractor work by the numbers of hectares of tractor work performed. In order to do this, it is necessary to know the total number of hectares of tractor work performed in a year, broken down into hectares worked by kerosene, diesel, and ligroine tractors, together with the average fuel expenditure per hectare by each of these types of tractor in the same year. Fortunately, Soviet sources have supplied all the factors necessary for making these calculations for tractors in machine tractor stations (MTS's) during 1940, 1947, and 1951. The task has been simplified by the fact that Soviet reports of tractor performance for all types of tractor work are converted by Soviet statisticians into a standard accounting unit -- the hectare of soft plowing -- so that there is no necessity to take into account the effect of different types of tractor work on fuel consumption.

Table 3** details the calculation of the consumption of fuels and lubricants by agricultural tractors located in the MTS's in 1940, 1947, and 1951. Consumption of lubricants and consumption of gasoline used for starting tractors using heavy fuels are calculated from Soviet norms for expenditure of these products as a percentage of total fuel expenditure.

All data supplied by Soviet sources deal only with the tractors located in the MTS's, and no similar data were found for tractors on State farms. In order to estimate the fuel consumption of all agricultural tractors in the USSR, it was necessary to use estimates of the percentage of ; total agricultural horsepower owned by the MTS's. This task was made easier by the fact that Soviet sources usually discuss tractors in terms of an accounting unit -- the 15-horsepower tractor -- and because Soviet sources provide data on the productivity of this accounting unit. The validity of this method also depends on the unverified assumption that on the land worked by the State farms there is the same percentage breakdown between hectates worked by kerosene, ligroine, and diesel tractors.

* One hectare equals 2.471 acres.

** Table 3 follows on p. 9.

Table 3

Calculation of the Consumption of Petroleum Products by Agricultural Tractors in Machine Tractor Stations 1940, 1947, and 1951

Types of Tractor	Volume of Work 2/ (Percent of Total Tractor Work)	Volume of Work 3/ (Million Hectares of Soft Plowing)	Experienced Fuel Consumption 4/ (Kilograms per Hectare)	Total Fuel Consumption (Million Metric Tons)	Lubricant Norms 5/ (Percent of Fuel)	Lubricant Consumption (Million Metric Tons)	Gasoline Norms 6/ (Percent of Fuel)	Gasoline Consumption (Million Metric Tons)
1940								
Kerosene								
SKhTZ a/*	54	121.5	17.8	2.16	10.0	0.22	1.5	0.03
U b/ Model	12	27.0	15.3	0.41	10.0	0.04	1.5	0.01
STZNATI c/ Model	8	18.0	15.9	0.29	11.5	0.03	3.0	Negligible
Total for Kerosene Tractors	74	166.5		2.86		0.29		0.04
Ligroine	20	45.0	15.9	0.72	10.0	0.07	1.5	0.01
Diesel	6	13.5	10.4	0.14	17.0	0.02	3.0	Negligible
Total for 1940	100	225.0		3.72		0.38		0.05

* Footnotes for Table 3 follow on p.11.

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Table 3

Calculation of the Consumption of Petroleum Products by Agricultural Tractors in Machine Tractor Stations 1940, 1947, and 1951 (Continued)

Types of Tractor	Volume of Work 2/ (Percent of Total Tractor Work)	Volume of Work 3/ (Million Hectares of Soft Plowing)	Experienced Fuel Consumption 4/ (Kilograms per Hectare)	Total Fuel Consumption (Million Metric Tons)	Lubricant Norms 5/ (Percent of Fuel)	Lubricant Consumption (Million Metric Tons)	Gasoline Norms 6/ (Percent of Fuel	Gasoline Consumption (Million Metric Tons)
1947								
Kerosene		97.5	19.5	1.90	10.0	0.19	1.5	0.03
SKhTZ Model	54	14.5	17.3	0.25	10.0	0.03	1.5	Negligible
U Model	8	30.7	17.9	0.55	11.5	0.06	3.0	0.02
STZNATI Model	17							
Total for Kerosene Tractors	79	142.7		2.70		0.28		0.05
Ligroine	13	23.5	18.2	0.43	10.0	0.04	1.5	0.01
Diesel	2	3.6	12.3	0.04	17.0	0.01	3.0	Negligible
Total for 1947	94 d/	180.6 d/		3.17		0.33		0.06
1951								
Kerosene								
SKhTZ Model	26.7	102.1	16.4	1.67	10.0	0.17	1.5	.03
U Model	5.8	22.2	14.0	0.31	10.0	0.03	1.5	Negligible
STNATI Model	30.3	115.9	15.2	1.76	11.5	0.20	3.0	0.5
Total for Kerosene Tractors	62.8	240.2		3.74		0.40		.08

Table 3

Calculation of the Consumption of Petroleum Products by Agricultural Tractors in Machine Tractor Stations 1940, 1947, and 1951 (Continued)

Types of Tractor	Volume of Work 2/ (Percent of Total Tractor Work)	Volume of Work 3/ (Million Hectares of Soft Plowing)	Experienced Fuel Consumption 4/ (Kilograms per Hectare)	Total Fuel Consumption (Million Metric Tons)	Lubricant Norms 5/ (Percent of Fuel)	Lubricant Consumption (Million Metric Tons)	Gasoline Norms 6/ (Percent of Fuel)	Gasoline Consumption (Million Metric Tons)
1951 (Continued)								
Ligroine	5.7	21.8	15.2	0.33	10.0	0.03	1.5	Negligible
Diesel	31.1	119.0	9.98	1.19	17.0	0.20	3.0	0.04
Total for 1951	99.6 d/	382.5 d/		5.26		0.63		.12

a. Stalingrad Kharkov Traktor Zavod.
b. Universal.
c. Stalingrad Traktor Zavod, Nauchno - Autotraktornyy Institut (Scientific Automobile and Tractor Institute).
d. There is a discrepancy in the total because of a discrepancy in the source material.
e. There is a discrepancy in the total because it was taken from a separate source.

Soviet sources indicate that in 1940, 81.4 percent of the horsepower of the Soviet agricultural tractor park was located in the MTS's. 7/ It has been assumed that this percentage was the same in 1947. It has been estimated that by 1951, 85 percent of the total agricultural tractor park was located in the MTS's. 8/ Table 4 presents estimates of the consumption of petroleum products by all agricultural tractors in the USSR derived by applying these percentage estimates to the data included in Table 3.

Table 4

Estimated Consumption of Petroleum Products
by all Agricultural Tractors in the USSR
1940, 1947, and 1951

	Million Metric Tons		
Petroleum Products	1940	1947	1951
Kerosene	3.51	3.32	4.40
Ligroine	0.88	0.53	0.39
Diesel	0.17	0.05	1.40
Lubricants	0.47	0.41	0.74
Gasoline	0.06	0.07	0.14
Total	5.09	4.38	7.07

Since the data in Table 3 were supplied completely from Soviet sources, the estimates of fuel consumption by tractors in the MTS's are as reliable as the Soviet data themselves. In preparing Table 4 it is possible that the estimate of the percentage of total agricultural tractor horsepower located in the MTS's is not accurate, but the error introduced by the use of this percentage should not exceed plus or minus 5 percent. The estimates of consumption of lubricants and gasoline may be somewhat low, since they are derived from Soviet norms, which may be optimistic. The effect of this error on the total consumption of petroleum products should be negligible, since lubricants and gasoline constitute only a small part of total petroleum consumption.

b. 1950 and 1952-55.

The hectare approach used above is also used in estimating the consumption of petroleum products by agricultural tractors during the base year used, 1950, and the period 1952-55. Data supplied by the Fifth Five Year Plan permit this approach. The hectares worked by the different

types of tractor were, however, computed by a different method. The size and breakdown of the park of agricultural tractors has been attempted and used in conjunction with the average output per tractor.

In 1950 the USSR had an estimated tractor park of 800,000 15-horsepower units (see Table 5),* and the average yearly output per tractor was 469 hectares of soft plowing. According to the Fifth Five Year Plan the agricultural tractor park is to grow 50 percent, and the yearly output per 15-horsepower tractor unit is to increase 50 percent between 1950 and 1955. The increase in the tractor park seems to be quite feasible, since an increase in the park of 50 percent over 5 years represents a slower rate of net growth than was the case during the last years of the Fourth Five Year Plan (1946-50). The planned increase in the productivity of the 15-horsepower tractor unit also seems within the realm of possibility, since overage prewar tractors can be expected to drop out of the park through depreciation, and new, more efficient tractors will take their place. In any event, no alternative estimates of the productivity of the Soviet tractor park during the period 1950-55 are presently available, and, therefore, Fifth Five Year Plan data were used in this report.

On this basis, there is presented in Table 5 the estimated size of the agricultural tractor park in 15-horsepower units, as well as the productivity per 15-horsepower tractor unit, for the period 1950-55. In addition to the 1950 and 1955 data, derived as indicated above, 1951 data are also derived from Soviet sources. During 1952-54, for which no direct evidence is available, the increases in numbers of 15-horsepower tractor units and productivity per unit necessary to reach the 1955 planned levels have been equally prorated to each of these years.

The breakdown of the tractor park into different types of tractors makes use of the statement from a Soviet source that, in 1950, 25 percent of the agricultural tractor park horsepower was diesel (1/4 x 800,000 = 200,000) 11/ and that, in 1951, approximately one-third of the horsepower was diesel (1/3 x 930,000 = 310,000). 12/ This would mean, apparently, that the diesel tractor park increased from 200,000 to 310,000, or by 110,000, 15-horsepower units. From Table 5 it will be seen that the entire tractor park showed a net increase of 130,000 15-horsepower units in 1951. This means that about 85 percent of the net additions of 15-horsepower tractor units to the park in 1951 were diesel. This percentage has been used in determining the net number of diesel units which were added to the park between 1951 and 1955. The remaining tractor units added in each year are considered to be kerosene-fueled. In the case of ligroine tractors it is estimated that there were approximately 53,000 15-horsepower units in the park in 1951, since Table 3 indicates that ligroine tractors performed a total of 21.8 million hectares of work, and the average 15-horsepower unit performed 484 hectares of work in the same period. These 53,000 ligroine 15-horsepower units are arbitrarily held constant through the period.

* Table 5 follows on p. 14.

Table 5

Estimated Size of the Agricultural Tractor Park of the USSR and Estimated Average Productivity per 15-Horsepower Tractor Unit 1950-55

Year	Estimated Tractor Park (15-Horsepower Units)	Estimated Productivity per 15-Horsepower Tractor Unit (Hectares of Soft Plowing)
1950	800,000 a/	469 b/
1951	930,000 a/	484 b/
1952	997,000	539
1953	1,065,000	594
1954	1,132,000	649
1955	1,200,000	704

a. State Department estimate. 9/
b. Soviet source. 10/

Table 6 presents the estimated composition of the Soviet tractor park derived from these assumptions. In order to obtain the numbers of

Table 6

Estimated Composition of the Agricultural Tractor Park of the USSR 1950-55

Types of Tractor	Thousand 15-Horsepower Tractor Units					
	1950	1951	1952	1953	1954	1955
Diesel	200	310	368	426	484	542
Kerosene	547	567	576	586	595	605
Ligroine	53	53	53	53	53	53
Total	800	930	997	1,065	1,132	1,200

hectares worked each year by each type of tractor, the number of 15-horsepower tractors of each type is multiplied by the average output per tractor. The results are presented in Table 7. The year 1951 has been omitted from Table 7, since data for this year have already been presented in Table 3.

Table 7

Estimated Hectares Worked by the Agricultural Tractor Park of the USSR, by Types of Tractor 1950 and 1952-55

	Million Hectares of Soft Plowing				
Types of Tractor	1950	1952	1953	1954	1955
Diesel	94	198	253	314	382
Kerosene	257	310	348	386	426
Ligroine	25	29	31	34	37
Total	376	537	632	734	845

Finally, to arrive at fuel consumption for the years between 1950 and 1955, the number of hectares worked by each type of tractor is multiplied by the average fuel expenditure per hectare of that particular type of tractor. Fuel consumption factors for 1951 are used for all years between 1950 and 1955. Though fuel consumption per hectare decreased between 1947 and 1951, there is no indication that further decreases will necessarily occur, since the 1951 fuel consumption per hectare is already below the 1950 level. Table 8* summarizes the consumption of petroleum products by agricultural tractors in the USSR calculated from the foregoing discussion. Consumption of lubricants and starting gasoline was again calculated on the basis of Soviet norms, with the small difference that no attempt has been made to break down the consumption of these products as between the different types of kerosene tractors, and an average for all types of kerosene tractors was used instead.

The range of error present in these estimates would appear to be somewhat greater than that present in the estimates for 1940, 1947, and 1951. The estimates for 1950 should not be in error by more than plus or minus 10 percent. The estimates for 1952-55 are subject to progressively greater possible error, since they are based on the Fifth Five Year Plan. All the estimates of consumption of lubricants and starting gasoline may be somewhat low.

* Table 8 follows on p. 16.

Table 8

Estimated Consumption of Petroleum Products by all Agricultural Tractors in the USSR 1950 and 1952-55

Million Metric Tons

Product	1950	1952	1953	1954	1955
Kerosene	4.01	4.84	5.43	6.02	6.65
Ligroine	0.38	0.44	0.47	0.52	0.56
Diesel	1.00	1.98	2.52	3.13	3.81
Lubricants	0.64	0.90	1.06	1.23	1.42
Gasoline	0.13	0.18	0.21	0.24	0.27
Total	6.16	8.34	9.69	11.14	12.71

2. Combines.

Consumption of petroleum products by agricultural combines is estimated by a method similar to that used for agricultural tractors. Briefly, consumption by combines is calculated by multiplying the number of hectares harvested by combines by the unit fuel consumption per hectare. The problem is simplified by the fact that all combines are believed to operate on gasoline. It is complicated, however, by the fact that there are two basic types of combine in operation in the USSR: tractor-drawn and self-propelled combines. Both types are motor-driven, but the self-propelled combines consume more fuel per hectare. It is therefore necessary to break down the number of hectares harvested by combines into the amounts harvested by each of the two types of combine. Since this breakdown is not directly available from Soviet sources, it has been made on the basis of the estimated numbers and productivities of the different types of combine in the Soviet park.

The number of total hectares of grain crops harvested by combines during 1950 and 1951 has been estimated on the basis of Soviet information. Since the Fifth Five Year Plan indicates no increase in the number of hectares of grain crops during 1950-55, it has been assumed that for the period 1952-55 it will remain constant at the 1951 level. Soviet sources supply the percentage of total hectares of grain harvested by combines in 1950 and 1951, and the planned percentage increase for 1952 and 1955. This increase has been prorated equally to each of the years from 1953 through 1955. Table 9* shows the estimates which have been made of hectares harvested by combines during 1950-55.

* Table 9 follows on p. 17.

Table 9

Estimated Hectares of Grain Crops Harvested by Combines
in the USSR
1950-55

	1950	1951	1952	1953	1954	1955
Total Hectares of Grain Crops (Millions) 13/	101.9	106.0	106.0	106.0	106.0	106.0
Percent Harvested by Combines	50.0 14/	60.0 15/	72.0 16/	78.0	84.0	90.0 a/
Hectares Harvested by Combines (Millions)	51.5	63.6	76.3	82.6	89.0	95.4

a. Fifth Five Year Plan.

Table 10* shows the estimates of the composition of the combine park used in calculating fuel consumption by combines. Table 10 is prepared on the basis of the following facts and assumptions.

a. Prewar.

(1) Prewar production of combines is assumed to have been equally divided between the Kommunar and S-1** models. 17/

(2) 49,000 prewar combines were destroyed by the Germans. 18/

(3) Combines are assumed to have a service life of 12 years.

b. Postwar.

(1) The number of postwar combines delivered to agriculture, with a breakdown between self-propelled and tractor-drawn models, is based on CIA estimates of production.

(2) Tractor-drawn combines produced prior to 1947 are assumed to be Kommunar models. 19/

* Table 10 follows on p. 16.
** S refers to Stalinets.

Table 10

Estimated Composition of the Combine Park of the USSR
1950-55

Thousand Combines

Types of Combine	1950	1951	1952	1953	1954	1955
Prewar Combines						
Tractor-Drawn Models						
S-1	18.7	10.3	7.0	2.3	0	0
Kommunar	18.7	10.4	7.1	2.4	0	0
Subtotal	37.4	20.7	14.1	4.7	0	0
Postwar Combines						
Tractor-Drawn Models						
Kommunar	0.3	0.3	0.3	0.3	0.3	0.3
S-6	42.3	65.9	89.9	107.9	119.9	131.9
Self-Propelled Models						
S-4	27.5	53.5	82.5	103.5	117.5	131.0
Subtotal	70.1	119.7	172.7	211.7	237.7	263.2
Total	107.5	140.4	186.8	216.4	237.7	263.2

(3) A utilization factor of 50 percent has been applied to combines delivered to agriculture during the year of delivery.

(4) Yearly deliveries of combines to agriculture during 1953-55 are assumed to be made at a rate 50 percent lower that that calculated for 1950-52. This assumption has been made, since Table 9 indicates that the number of hectares harvested by combines will increase only 6 percent per year during 1953-55, whereas it increases at an average of 11 percent per year between 1950 and 1952.

In determining the number of hectares harvested by the various types of combine, use has been made of Soviet data concerning the productivity of different models of combines. Table 10 shows the estimated composition of the combine park, and Table 11* shows the estimated hectares harvested by various models. The rated productivity of the S-4 and the Kommunar models is 1.8 hectares per hour, 20/ and that of the S-6 model is 2.2 hectares per hour,

* Table 11 follows on p. 19.

Table 11

Estimated Hectares of Grain Crops Harvested by Models of Combines in the USSR 1950-55

Million Hectares

Models of Combines	1950	1951	1952	1953	1954	1955
S-4	11.7	21.7	30.3	35.5	39.6	42.8
Kommunar	8.1	4.3	2.7	0.9	0	0
S-6 and S-1	31.7	37.6	43.3	46.2	49.4	52.6
Total	51.5	63.6	76.3	82.6	89.0	95.4

or 1.22 times that of the other combines. 21/ The productivity of the S-1 model is unknown, but it is assumed to be the same as that of the S-6, since both combines are powered by the same motor. In preparing Table 11, use is made of these productivity weightings. In addition, the assumption has been made that each type of combine is in operation for an equal period of time during the year.

In calculating the fuel and lubricant consumption of combines, Soviet fuel consumption rates of 4.5 kilograms per hectare for tractor-drawn combines 22/ and 10 kilograms per hectare for self-propelled combines 23/ have been used. The consumption of lubricants has been calculated on the basis of the Soviet norm for the consumption of lubricants per hectare. Table 12* details these calculations. 1940 and 1947 estimates are included on a relatively arbitrary basis.

Three major possible sources of error enter into this calculation. First, if the number of prewar combines in the park is smaller than that estimated, a greater proportion of the harvesting work will be done by the self-propelled combines, which have a higher fuel consumption rate. The reverse is equally true. Second, it is possible that some tractor-drawn combine models do not have motors, since it is known that experiments have been made with this type of equipment. 24/ If large numbers of these models are in use, the estimated petroleum consumption will be on the high side. Finally, the productivity and consumption factors which have been used may be somewhat in error, since they are based on Soviet norms and rated capacities, which may be optimistic. For these reasons, it is felt that the range of error present in these estimates may be as much as plus or minus 20 percent.

3. Stationary Motors in Agriculture and Tractors in the Timber Industry.

Information on these consuming units is extremely scanty in the Soviet sources which were examined. It was felt that further research on this subject would not yield information which would substantially revise

* Table 12 follows on p. 20.

Table 12

Estimated Consumption of Petroleum Products
by Combines in the USSR
1940-55

Million Metric Tons

	1940	1947	1950	1951	1952	1953	1954	1955
Gasoline Consumed								
S-4 Models			0.12	0.22	0.30	0.36	0.40	0.43
Kommunar Models			0.04	0.02	0.01	Negligible	0	0
S-6 and S-1 Models			0.14	0.17	0.20	0.21	0.22	0.23
Subtotal	0.35	0.26	0.30	0.41	0.51	0.57	0.62	0.66
Lubricants Consumed	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total	0.36	0.27	0.31	0.42	0.52	0.58	0.62	0.67

estimates of consumption which have been used previously. Earlier estimates of annual consumption by these units have totaled 0.1 million metric tons. This has been arbitrarily divided into 0.05 million metric tons of diesel and 0.05 million metric tons of gasoline. Lubricant consumption by these units is considered negligible.

4. Preliminary Estimates of the Consumption of Petroleum Products by Motor Transport in Agriculture.

The present state of knowledge about the composition and utilization of the agricultural motor transport park in the USSR is such that no accurate estimate can be made of the consumption of petroleum products by motor transport. It is possible, however, to hazard a guess on the order of magnitude of this consumption. (See Table 13.)*

The 1941 Plan shows that the People's Commissariat of Agriculture was allocated 3.34 percent of the total ton-kilometers of motor transport for the whole of the USSR; the People's Commissariat of State Farms, 5.61 percent; the People's Commissariat of the Timber Industry, 3.74 percent; and the People's Commissariat for Agricultural Procurement, 11.95 percent. Thus the planned ton-kilometers of motor transport involved in Soviet agriculture in 1941 was the equivalent of 25.04 percent of the total planned ton-kilometers of motor transport in the USSR.

* Table 13 follows on p. 21.

Table 13

Calculated Consumption of Petroleum Products
by Motor Transport in Agriculture in the USSR
1940, 1947, and 1950-55

Year	Ton-Kilometers Performed by All Motor Transport (Billion Ton-Kilometers)	Ton-Kilometers Performed by Motor Transport in Agriculture (Billion Ton-Kilometers)	Calculated Consumption of Petroleum Products by Motor Transport in Agriculture	
			Gasoline (Thousand Metric Tons)	Lubricants (Thousand Metric Tons)
1940	8.9	2.2	0.6	Negligible
1947	10.8	2.7	0.7	Negligible
1950	20.1	5.0	1.4	0.1
1951	23.7	5.9	1.6	0.1
1952	28.0	7.0	1.9	0.1
1953	31.1	7.8	2.2	0.1
1954	34.2	8.6	2.4	0.1
1955	37.2	9.3	2.6	0.1

The total ton-kilometers run by the entire motor transport park of the USSR have been estimated in an earlier report for 1940, 1947, and 1950-52. 25/ In addition, the increase in motor transport planned for 1955 in the Fifth Five Year Plan is known to be 80 to 85 percent of the 1955 level. It is therefore possible to interpolate a complete ton-kilometer series for all years between 1950 and 1955. In addition, a factor for expenditure for gasoline per ton-kilometer also has been derived -- 0.00027742 metric tons per ton-kilometer. 26/ If it is assumed that for all the years under consideration, agricultural motor transport accounted for 25.04 percent (the 1941 Plan figure) of the total ton-kilometers of motor transport -- it is possible to derive the consumption of petroleum products by motor transport in agriculture shown in Table 13. In addition, it is possible to estimate that the consumption of lubricants by motor transport in agriculture will be 4 percent of the gasoline consumed. 27/ No approximation of the consumption of diesel fuel by motor transport in agriculture is presented, since no information is available on which to base such an approximation. The approximations of the consumption of petroleum products shown in Table 13 are subject to an extremely wide range of error.

APPENDIX B

GAPS IN INTELLIGENCE

The purpose of this appendix is to indicate wherein the material upon which this report is based is inadequate and wherein coverage of the subject is incomplete. This is done both to enable better evaluation of the estimates presented and to point out where further research may prove of value.

1. Agricultural Tractors.

a. 1940, 1947, and 1951.

Though data on the consumption of petroleum products by the tractor park of the MTS's for these years have been supplied completely by Soviet sources and no further research in this area is justified, the lack of information on consumption by agricultural tractors other than those of the MTS's creates an important source of error in estimates of total consumption by tractors in agriculture. These data have not been found for postwar years. They would be of great value if given at some future date in Soviet publications, or if estimated on the basis of intense research.

b. 1950.

The estimates for the year 1950 could be made more accurate either if an exact breakdown of 1950 nondiesel horsepower between ligroine and kerosene horsepower could be made, or if Soviet publications subsequently provide a breakdown of hectares worked by the different fuel-type tractors that obviates the necessity of estimating the composition of the tractor park. It should be stressed that all efforts should be made to make this estimate as precise as possible since 1950 will undoubtedly be used as a base year in Soviet statistics.

c. 1952-55.

Estimates for 1952-55 are based on data from the Fifth Five Year Plan. The Plan figures on increases in tractor horsepower and in output per tractor unit should be revised as further material becomes available. Important factors not supplied by the Plan are the comparative numbers of diesel tractors and kerosene tractors to be added to the park during the 5-year period, and information as to whether or not the present rates of fuel consumption per hectare are to decrease. The latter is particularly important, as is shown by the fact that using 1947 fuel consumption factors for 1951 results in an error of approximately 2 million metric tons.

2. Combines.

The estimates of consumption of petroleum products by combines are not as reliable as estimates of consumption by tractors. It is firmly believed, however, that the amount of time already devoted to research on this subject is the maximum that can be spent profitably. It is doubtful that further research would uncover more accurate information. The present estimates are the result of considerable research and of a complex methodology. The results obtained are believed to represent the extreme limits to which estimates of consumption by a single category of petroleum-consuming equipment can be carried.

3. Stationary Motors in Agriculture and Tractors in the Timber Industry.

No over-all statistics have been found on consumption of petroleum products by stationary motors in agriculture and tractors in the timber industry. To estimate the inventory of equipment and find consumption factors in both these fields would require elaborate research which would not necessarily produce reliable results. In view of this fact, and since the amount of petroleum involved is thought to be extremely small, it was considered more practical to make an arbitrary estimate.

4. Motor Transport in Agriculture.

Essential prerequisite to accurate estimates of the petroleum products consumed by motor transport in Soviet agriculture are accurate data on the inventory of the truck park in agriculture and on its utilization. Alternatively the ton-kilometers performed by trucks in agriculture would be necessary. These data are not available, nor is it anticipated that it will be possible to obtain acceptable estimates of these items except by the most painstaking and lengthy research. This, in short, is a gap in present intelligence which will not readily be filled.

It is fortunate, therefore, that the need for an estimate of the consumption of petroleum products by motor transport in Soviet agriculture is one which is quite specialized and not generally required for intelligence purposes. As has been implied in this report, estimates of the consumption of petroleum products by all motor transport in the USSR are presently available. Presently available intelligence, however, does not permit accurate itemizing of these estimates for the sectors of motor transport attached to agriculture or to other economic or political subgroups of the Soviet economy.

5. Possible Further Refinements.

The breakdown of agricultural consumption by regions presented in Table 2 is based on distribution of the MTS's by regions according to the 1941 Plan. Obviously, more recent information should be used, but it is not

readily obtainable, and the concentrated research necessary to improve these estimates would require more time than is available.

No attempt was made to provide a quarterly breakdown of annual petroleum consumption by agriculture. This breakdown would be of value in indicating when agricultural demands for petroleum products would compete with possible wartime military requirements. In order to obtain this breakdown, it would be necessary to find indexes of the distribution of tractor work and combine work during the year.

APPENDIX C

SOURCES AND EVALUATION OF SOURCES

1. Evaluation of Sources.

This report was prepared largely from published Soviet source materials. Fifth Five Year Plan figures were used in estimating the growth in size and productivity of the agricultural tractor and combine parks, since no other figures are as yet available. Information on the composition, utilization, and fuel consumption of the Soviet agricultural tractor park was based largely on data from Soviet technical and agricultural journals. Information from these publications is considered to be reliable, since it was prepared for internal use by Soviet management and planners. Where published Soviet source materials failed to provide the necessary data, recourse was had to intelligence estimates based on analysis of Soviet source material. Among the best of these were reports from the Department of State, particularly OIR Intelligence Report 5805.

The range of error believed to be present in each component estimate in this report is discussed in some detail in the sections of the report in which the estimates are developed.

2. Sources.

Evaluations, following the classification entry and designated "Eval.," have the following significance:

Source of Information	Information
A - Completely reliable	1 - Confirmed by other sources
B - Usually reliable	2 - Probably true
C - Fairly reliable	3 - Possibly true
D - Not usually reliable	4 - Doubtful
E - Not reliable	5 - Probably false
F - Cannot be judged	6 - Cannot be judged

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation of the cited document.

1. CIA, N/5 783.3.R92, The 1941 State Plan for the Development of the National Economy of the USSR. U.
2. Data for 1940 and 1947 taken from Mashinno-Traktornaya Stantsiya, No. 9, Sep 1948. U. Eval. RR 2.
Data for 1951 taken from Sotsialisticheskoye Sel'skoye Khozyaystvo (Socialist Agriculture), Aug 1952, p. 10. U. Eval. RR 2.
3. Totals taken from Department of State, OIR, Intelligence Report 5805, Major Developments in Soviet Agriculture in 1951, 20 May 1952, p. 20. R.
4. Data for 1940 and 1947 taken from Mashinno-Traktornaya Stantsiya, No. 9, Sep 1948. Eval. RR 2.
Data for 1951 taken from Sotsialisticheskoye Sel'skoye Khozyaystvo, op. cit. Eval. RR 2
5. B.S. Svirshchevskiy, Eksploatatsiya mashinno-traktornogo parka (Utilization of the Machine-Tractor Park), 1950, p. 229. U. Eval. RR 2.
6. Ibid.
7. Mashinno-Traktornaya Stantsiya, No. 11, Nov 1947, p. 2. U. Eval. RR 2.
Planovoye Khozyaystvo (Planned Economy), Mar 1947, p. 49. U. Eval. RR 2.
8. Department of State, OIR, Intelligence Report 5805, op. cit.
9. Ibid.
10. Izvestiya, 11 Mar 1952. U.
11. A. Kuropatkin, Voprosy ekonomiki sel'skokhozyaystvennogo truda v SSSR (Problems of Economics of Agricultural Labor in the USSR), 1952, p. 165. U. Eval. RR 2.
12. Department of State, OIR, Intelligence Report 5878, Draft Power in Soviet Agriculture, 17 Apr 1952, p. 3. R.
13. Department of State, OIR, Intelligence Report 5805, op. cit., p. 11.
14. A. Kuropatkin, op. cit., p. 199.
15. Planovoye Khozyaystvo, Jan 1952, p. 8. U. Eval. RR 2.
16. Sotsialisticheskoye Sel'skoye Khozyaystvo, Jun 1952, p. 5. U. Eval. RR 2
17. Sel'khozmashina (Agricultural Machinery), Jul 1950, p. 2. U. Eval. RR 2.
18. P. Kolomiitsev, Tekhnicheskoye osnashcheniye sel'skogo khozyaystva (The Technical Equipment of Agriculture), 1947, p. 9. U. Eval. RR 2.
19. Sel'khozmashina, Jul 1950, p. 2. U. Eval. RR 2.
20. M.N. Portnov, Samokhodnyy kombain (The Self-Propelled Combine), 1950, p. 4. U. Eval. RR 2.
21. Sel'khozmashina, Jul 1950, p. 2. U. Eval. RR 2.
22. Sel'khozmashina, Jul 1951, pp. 10 and 11. U. Eval. RR 2.
23. Portnov, op. cit.
24. Sel'khozmashina, Jul 1951, pp. 10 and 11. U. Eval. RR 2.
25. CIA/RR PR-17, Civil Consumption of Petroleum Products in the USSR, 19 Jun 1952. TS. Classification of this excerpt, R. Eval. RR 1.
26. Ibid.
27. B.V. Losikov and I.P. Lukashevich, Neftanoye Tovardovediye gostoptekhizdat 1950, Moscow - Leningrad.

In addition to the above specific citations, a general screening was made of all the issues available in the Library of Congress of the following Soviet periodicals for the years 1946-52:

Mashinno-Traktornaya Stantsiya (Machine Tractor Station)
Sotsialisticheskoye Sel'skoye Khozyaystvo (Socialist Agriculture)
Sel'khozmashina (Agricultural Machinery)
Automobil'naya i Traktornaya Promyshlennost' (Automobile and Tractor Industry)
Planovoye Khozyaystvo (Planned Economy)
Voprosy Ekonomiki (Problems in Economics)

A considerable number of Soviet books and relevant reference material were also consulted.